

REMARKS

Claims 1-2 are pending in the above-identified application and stand ready for further action on the merits.

Rejections under 35 U.S.C. § 103

At pages 2-4 of the Office Action, the Examiner sets forth the following rejections:

1. A rejection of claim 1 under 35 USC § 103(a) as being unpatentable over Vestal US '529 (US 4,958,529) in view of Huber US '976 (US 4,989,976), Barnes US '935 (US 4,688,935) and Carnahan US '861 (US 5,723,861); and
2. A rejection of claim 2 under 35 USC § 103(a) as being unpatentable over Vestal US '529 in view of Huber US '976, Barnes US '935 and Carnahan US '861, as applied to claim 1, and further in view of Mitsumaki US '183 (US 4,696,183).

Applicants respectfully traverse, and request reconsideration and withdraw of each of these rejections based upon the following considerations.

The Present Invention and Its Advantages

The present invention is directed to a liquid organometallic compound vaporizing and feeding system having (i) a liquid reagent passageway which connects a liquid reagent container containing a liquid organometallic compound to a vaporizer for vaporizing the liquid reagent via a liquid mass flow controller for controlling the flow rate of the liquid reagent, (ii) a carrier gas passageway which connects a carrier gas source to the vaporizer via a carrier gas mass flow controller, and (iii) a sample gas passageway which is connected to a sample inlet of an ICP emission spectrometer via an in-line monitor disposed downstream of the vaporizer. Further, in

the present invention, a standard gas passageway having a gas mass flow controller disposed therein for controlling the flow rate of a standard gas for calibration is connected to the sample gas passageway. With this unique structure, the cumbersome and undesirable operation of sampling the liquid organometallic compound by means of a dispenser (e.g., a syringe) can be avoided, and subsequently safety can be significantly improved and the possible contamination can be prevented during the sampling operation. ICP analysis, where minute quantities of expensive organometallic compound are used, has a high sensitivity and an excellent reproducibility. With the liquid organometallic compound vaporizing and feeding system of the present invention, a plurality of standard gases for calibration can be generated at the same time, and quantitative and qualitative analyses of a wide variety of impurities can be conducted instantaneously. As a result, according to the present invention, ICP analysis with high sensitivity can be attained more reproducibly and more safely.

More specifically, in the liquid organometallic compound vaporizing and feeding system of the present invention, a liquid organometallic compound flowed from a reagent container is accurately measured and the flow rate thereof is controlled by a mass flow controller. Then, a liquid organometallic compound is vaporized and mixed with a carrier gas in a vaporizer, and the concentration of the completely vaporized organometallic compound is monitored with an in-line monitor. Thus, the organometallic compound gas having an accurate concentration can be steadily introduced into the ICP spectrometer. Also, since a calibration standard gas can be fed directly to the ICP spectrometer, the concentrations of impurities remaining in the organometallic compound gas can be analyzed qualitatively and quantitatively in the line. This structure make it possible to omit the cumbersome and dangerous operation of sampling the

liquid organometallic compound by means of a dispenser such as a syringe. Thus, with this system of the present invention, the safety under an operation of the analysis can be significantly improved, and the risk of contamination during the sampling operation can be avoided. Further, the ICP analysis using minute quantities of expensive organometallic compound can be more sensitive and more reproducible.

Another advantage of the liquid organometallic compound vaporizing and feeding system of the invention is that quantitative and qualitative analyses of a wide variety of impurities can be instantaneously performed since a plurality of standard gases for calibration can be generated at the same time. In this case, such a calibration of standard gases can be divided into a few groups so that chemical reaction between the compounds used in the standard gases can be prevented.

Distinction over Vestal US '529

Vestal '529 discloses an improved interface provided for receiving effluent from a chromatographic device and outputting sample particles of interest to a detector for analysis. The interface includes a gas diffusion cell having a membrane therein, which separates the cell into an aerosol flow chamber and a sweep gas flow chamber. The effluent is sprayed as an aerosol into the aerosol flow chamber, and vaporized solvent is diffused through the gas membrane into the sweep gas flow chamber while particles of interest are output to the detector. Sweep gas is passed through the sweep gas flow chamber for removing the solvent vapor, and the flow rate of sweep gas is controlled so as to achieve little or no net flow of gas across the membrane. Efficient solvent removal may be achieved at room temperature at certain LC flow

rates, and high detector resolution may be attained by maintaining laminar flow of the carrier gas through the aerosol flow chamber, in the cited reference.

However, Vestal '529 fails to disclose or teach the use of a liquid mass flow controller and the use of an in-line monitor as recited in claim 1.

Therefore, Vestal '529 does not give any motivation to arrive at the present invention.

Moreover, in Vestal '529, the introduction of a sample is conducted by a spraying method. In such as method (i.e., the spraying), the sample is formed in shape of droplets at spraying. In this case where the spraying method is employed as a sample introduction method, however, only a little amount (e.g., several %) of the droplets formed by spraying are introduced in the ICP. Thus, the value of the ICP measurement does not represent the real impurity of concentration in the sample.

In the present invention, on the other hand, since the introduction of the sample to ICP is conducted by a vaporizing method, substantially entire vaporized sample is introduced into ICP. Thus, the concentration of impurities in the sample is measured more accurately.

Accordingly, Vestal '529 does not give any motivation to arrive at the present invention.

Distinction over Huber US '976

Huber US '976 discloses the following:

"In a device for supplying liquid to an atomization device operating with a nebulizer (22) in a spectrometer, the liquid is fed to the nebulizer (22) by a peristaltic pump (10) through a supply conduit (12). A valve (18) responding to liquid pressure is arranged closely in front of the nebulizer (22) and controls a connection between the supply conduit (12) and an outlet (30) through which excess liquid can flow off. A sensor (44) responding to the opening of the valve (18) is adapted to control the speed of the peristaltic

pump (10), such that the quantity fed by the peristaltic pump (10) is slightly larger than the feeding capacity of the nebulizer (22)." (see Abstract)

Huber US '976 merely discloses the use of a liquid flow controller.

However, Huber US '976 fails to disclose or suggest "an in-line monitor."

Like Huber US '976, if only the liquid mass flow controller is provided without the in-line monitor, the amount of a sample introduced in ICP cannot be measured correctly. Thus, since a significant difference in the concentration of impurities between the real value and the measured value are found, the accurate analysis cannot be achieved with the devise of Huber US '976.

In the present invention, on the other hand, the concentration of the sample is directly measured by an in-line monitor, and thereafter the sample is introduced in ICP.

Therefore, the concentration of impurities can be correctly measured.

Moreover, similar to Vestal '529, the introducing method of the sample disclosed in Huber US '976 is also a spraying method. Thus, Huber US '976 also has the same disadvantages as explained above.

Accordingly, Huber US '976 does not give any motivation to arrive at the present invention.

Distinction over Barnes US '935

Barnes US '935 discloses a method of analyzing a volatile, air or moisture sensitive or pyrophoric, liquid, organometallic compound for an impurity comprising inserting a sample of the compound into an exponential dilution flask, allowing substantially the entire sample to vaporize,

and analyzing the vapor by plasma spectroscopy; or decomposing the sample by dropwise addition into frozen aqueous acid, diluting the decomposed sample with water, and analyzing the diluted, decomposed sample by plasma spectroscopy.

However, as disclosed at column 4, line 15 of Barnes US '935, the liquid sample is injected by using a syringe. The use of the syringe can render analysis unfavorable (e.g., (i) a possibility of human damage caused by poisoning or burn during the sampling operation and introduction into a heater, (ii) contamination of the organometallic compound during the sampling operation, and (iii) repeatedly sampling on every analysis). (See also description at page 3, lines 10 to 18 of the present specification.)

Further, Barnes US '935 fails to disclose or suggest the use of an in-line monitor.

Therefore, Barnes US '935 does not give any motivation to arrive at the present invention.

Distinction over Carnahan US '861

Carnahan US '861 merely discloses a recirculating filtration system for use with a transportable ion mobility spectrometer. In Carnahan US '861, a gas cylinder is disclosed.

However, Carnahan US '861 fails to specifically disclose or suggest the features of the present invention (e.g., the liquid mass flow controller and the liquid mass monitor).

Accordingly, Mitsumaki US '183 does not provide any motivation to arrive at the present invention.

Distinction over Mitsumaki US '183

Mitsumaki US '183 also fails to specifically disclose or suggest the features of the present invention (e.g., the liquid mass flow controller and the liquid mass monitor).

Thus, Mitsumaki US '183 does not provide any motivation to arrive at the present invention.

Combination of the Cited References

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

Further, the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

Further, the prior art can be modified or combined to reject claims as *prima facie* obvious as long as there is a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

In this case of the present application, as explained above, none of the cited references provide any motivation to arrive at the present invention, since these reference fail to disclose or

suggest the feature of the present invention (e.g., the liquid mass flow controller and the liquid mass monitor).

Accordingly, the present invention is not obvious over the cited references.

CONCLUSION

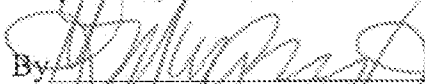
Based upon the amendments and remarks presented herein, the Examiner is respectfully requested to issue a Notice of Allowance clearly indicating that each of the pending claims 1-2 are allowed under the provisions of Title 35 of the United States Code.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Gerald M. Murphy, Jr. (Reg. No. 28,977) at the telephone number below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

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Respectfully submitted,

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